

Sellers *in litt.* 2001). The City of Chico also has a conservation easement on 118 hectares (292 acres) of habitat that appears to be suitable for *L. floccosa* ssp. *californica*, although very few of the plants are present (C. Sellers *in litt.* 2001). The Dove Ridge Conservation Bank, which contains over 200 acres of vernal pool habitat, is operated as conservation bank for this and other vernal pool species. The Center for Natural Lands Management holds a conservation easement and conducts management and monitoring of the site (M. Wacker *in litt.* 2005).

Other conservation efforts for *Limnanthes floccosa* ssp. *californica* have been accomplished through mitigation programs. The Bruce-Stilson population was enhanced by spreading nutlets to unoccupied areas within a proposed preserve (Stern 1992, K. Stern *in litt.* 1994). *Limnanthes floccosa* ssp. *californica* also was introduced onto suitable, unoccupied habitat on the Tuscan Preserve (also known as Lower Wurlitzer Ranch) in 1992 and 1993 (Kelley *et al.* 1994). The population has continued to reproduce and expand, increasing to approximately 200,000 plants by the spring of 2000 (C. Sellers *in litt.* 2001).

6. NAVARRETIA LEUCOCEPHALA SSP. PAUCIFLORA (FEW-FLOWERED NAVARRETIA)

a. Description and Taxonomy

Taxonomy.—Navarretias are members of the phlox family (Polemoniaceae). Mason (1946) first gave few-flowered navarretia the Latin name *Navarretia pauciflora*. He had collected the type specimen “5 miles north of Lower Lake, Lake County” in 1945 (Mason 1946). Day (1993a) subsequently reduced few-flowered navarretia in rank and assigned it the name *Navarretia leucocephala* ssp. *pauciflora*.

Some plants exhibit characteristics intermediate between *Navarretia leucocephala* ssp. *pauciflora* and ssp. *pliantha*. According to Dr. Alva Day (A. Day *in litt.* 1993, *in litt.* 1997, pers. comm. 1997), such plants cannot be assigned definitively to either subspecies. She does not consider these intergrades (intermediate plants) to be hybrids because there is no evidence that they resulted from crosses between the two subspecies. Thus, the characterization of these intermediate plants as “intercrosses” in the final rule (U.S. Fish and Wildlife Service 1997b) was misleading. The existence of such intermediate forms was Dr. Day’s primary reason for reducing several taxa previously treated as full species to subspecies within *N. leucocephala* (Day 1993a, A. Day pers. comm. 1997). The distribution, life history, threats, conservation efforts, and recovery strategy for intergrades are discussed in the species account for *N. leucocephala* ssp. *pliantha*.

Description and Identification.—Navarretias are annual herbs with alternate, usually lobed leaves that also may have secondary lobes. The small, funnel-shaped flowers have four or five corolla lobes and a tubular calyx with four or five sepals joined at the base by a papery membrane. *Navarretia* flowers are clustered into head-like inflorescences that are surrounded by spine-tipped bracts similar to the leaves. The small capsules are egg-shaped and contain one or more tiny seeds (Day 1993b). All *Navarretia* species and subspecies that occur in vernal pools apparently evolved from a single ancestor and share a suite of characteristics including short stature, simple stem anatomy, few glands, very short stigmas, a single vein leading to each corolla lobe, stamens attached near or at the top of the corolla tube, a membranous-walled capsule that does not split along predetermined lines, and few seeds (Crampton 1954, Spencer 1993).

Navarretia leucocephala ssp. *pauciflora* (**Figure II-9**) is only 1 to 4 centimeters (0.4 to 1.6 inches) tall but is twice as wide due to branches originating near the base of the stem. The stem is white with purple streaks and has few hairs. Although the majority of the stem is very slender (less than 0.5 millimeter [0.02 inch] thick), the portion at and just below ground level is two to four times as thick. The narrow leaves are 1 to 2.5 centimeters (0.4 to 1.0 inch) long and may have a few narrow lobes. Each flower head is 4 to 10 millimeters (0.16 to 0.39 inch) wide and contains between 2 and 20 pale blue or white flowers. The fruit of *Navarretia leucocephala* ssp. *pauciflora* is a papery capsule that breaks open in an irregular pattern only when it is wet. Each capsule contains one or two reddish-brown seeds that stick together until water washes them apart (Mason 1946, Day 1993b). The chromosome number of this taxon has not been determined.

Navarretia leucocephala ssp. *pauciflora* has fewer flowers per head and fewer lobes on the outer bracts than *N. leucocephala* ssp. *plieantha*. Also, the latter has narrower, needle-like tips on the bract lobes (A. Day *in litt.* 1993). Other navarretias that occur in vernal pools differ in growth habit or have more flowers per head, longer corollas with the tube extending beyond the calyx lobes, branching veins in the corollas, or stamens attached farther down the corolla tube. Those growing outside of vernal pools typically are covered with glandular hairs and have many corolla veins, longer stigma branches, and leathery capsules that split apart when dry; they also may differ in flower color or number of corolla and calyx lobes (Mason 1946, Crampton 1954, Day 1993b).

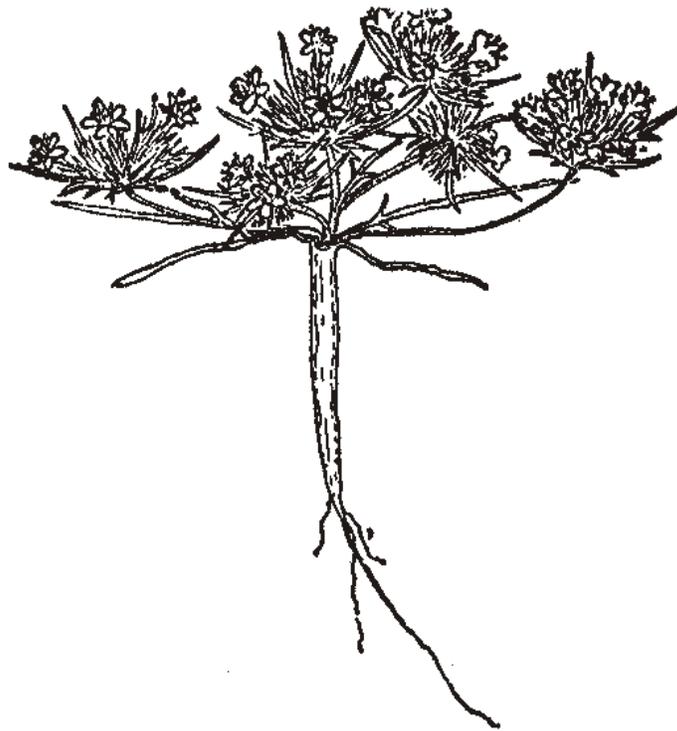


Figure II-9. Illustration of *Navarretia leucocephala* ssp. *pauciflora* (few-flowered navarretia). Reprinted with permission from Abrams (1951), *Illustrated Flora of the Pacific States: Washington, Oregon, and California*, Vol. III. © Stanford University Press.

b. Historical and Current Distribution

Historical Distribution.—Between 1923 and 1988, typical *Navarretia leucocephala* ssp. *pauciflora* specimens were collected from as many as nine sites in southern Lake County (A. Day *in litt.* 1997). The actual number of collection localities may have been fewer because some vaguely-described sites may in fact be the same as others described in greater detail. Manning Flat is presumed to be the type locality (California Natural Diversity Data Base 2003), even though it is actually west-northwest, rather than north, of Lower Lake. The specimens of typical *N. leucocephala* ssp. *pauciflora* were collected in the area between the towns of Clearlake, Kelseyville, and Middletown (Niehaus and Fruchter 1977, Bittman 1989, A. Day *in litt.* 1997). All of the historical sites were in the Lake-Napa Vernal Pool Region (Keeler-Wolf *et al.* 1998) (**Figure II-5**).

Intermediates between *Navarretia leucocephala* ssp. *pauciflora* and ssp. *pliantha* were collected historically from Loch Lomond and from the Siegler Springs Road area of Lake County. Those specimens have been cited as *N. leucocephala* ssp. *pauciflora* in some reports (*e.g.*, Niehaus and Fruchter 1977, Bittman 1989). The California Natural Diversity Data Base (2005) treats Loch Lomond as an occurrence of both *Navarretia leucocephala* ssp. *pauciflora* and ssp. *pliantha*. However, Day (*in litt.* 1993, *in litt.* 1997) does not consider collections from either Loch Lomond or Siegler Springs Road to represent *N. leucocephala* ssp. *pauciflora*.

Current Distribution.—Existing information is insufficient to clearly assess whether or not *Navarretia leucocephala* ssp. *pauciflora* has, in fact, significantly declined. Although two of the historical sites in Lake County are not confirmed to have extant populations, the vague original location information leaves open the possibility that these historical occurrences are actually the same as where the taxon is currently known.

Navarretia leucocephala ssp. *pauciflora* is restricted to the Lake-Napa Vernal Pool Region (Keeler-Wolf *et al.* 1998). Eight populations of typical *N. leucocephala* ssp. *pauciflora* are known or presumed to be extant (California Natural Diversity Data Base 2005), including three that were discovered during the past two decades (A. Howald *in litt.* 1995, California Natural Diversity Data Base 2005). Six of the eight extant occurrences are in Lake County and the other two are in Napa County. Among the Lake County occurrences, all six are south of Clear Lake within the area where the taxon was reported historically. One site in Lake County is farther south near the town of Cobb and was discovered in 1995 (J. Diaz-Haworth pers. comm. 2001). According to Howald (*in litt.* 1995), Dr. Alva Day verified the identity of the Cobb occurrence. The two Napa County

occurrences were also discovered within the past two decades. Both are in the Foss Valley-Milliken Canyon area east of Yountville (A. Day *in litt.* 1997, California Natural Diversity Data Base 2005).

There is one occurrence that contains both true *Navarretia leucocephala* ssp. *pauciflora* and populations of plants intermediate between *N. leucocephala* ssp. *pauciflora* and ssp. *plieantha*. These populations are in the vicinity of Loch Lomond and near Siegler Springs (A. Day *in litt.* 1993, *in litt.* 1997; California Department of Fish and Game 1994; California Natural Diversity Data Base 2005).

c. Life History and Habitat

Reproduction and Demography.—Little is known about the life history and demography of *Navarretia leucocephala* ssp. *pauciflora*. Like many vernal pool annuals, *N. leucocephala* ssp. *pauciflora* seeds germinate underwater (Crampton 1954) and flower after the pools dry (Day 1993a). The plants flower in May and June (California Department of Fish and Game 1994, Skinner and Pavlik 1994). The flowers are probably insect-pollinated. *Navarretias* with similar flowers that occur outside of vernal pools are pollinated by a variety of bees and bee flies (family Bombyliidae), although other insects may visit to collect nectar (Grant and Grant 1965). The seeds of *N. leucocephala* ssp. *pauciflora* do not disperse far from the parent plant because they have a gelatinous coating and stick together when the fruit ruptures (Crampton 1954, Day 1993b). Population sizes fluctuate widely among years (California Natural Diversity Data Base 2005).

Habitat and Community Associations.—*Navarretia leucocephala* ssp. *pauciflora* grows in vernal pools that form on substrates of volcanic origin (Bittman 1989, California Natural Diversity Data Base 2005), specifically in Northern Basalt Flow and Northern Volcanic Ashflow Vernal Pools (Sawyer and Keeler-Wolf 1995). Extant occurrences in Lake County are in “flats” of recent alluvium in mountainous areas; site-specific details are not available for Napa County sites. The vernal pools where *N. leucocephala* ssp. *pauciflora* occurs are interspersed with grassland or marsh and chaparral (Mason 1946, California Natural Diversity Data Base 2005). Pool sizes have not been well characterized, although this taxon has been reported from both small pools and large, shallow, playa-type lakes. Soils underlying the pools typically are shallow and rocky, and obsidian often is present on the surface (Mason 1946, California Natural Diversity Data Base 2003). The Manning Flat site has volcanic ash soil mapped as *Oxalis* variant silt loam, whereas one Milliken Canyon site has Aiken loam. Soil types are not known for the other occurrences. *Navarretia leucocephala* ssp. *pauciflora*

has been reported from elevations ranging from 445 to 707 meters (1,460 to 2,320 feet).

Associated plants differ among sites. In Lake County, associates include other rare plants: *Gratiola heterosepala*, *Parvisedum leiocarpum*, *Lasthenia burkei*, and *Eryngium constancei* (A. Howald *in litt.* 1995, California Natural Diversity Data Base 2003). Napa County associates include *E. aristulatum*, *L. conjugens*, and several species of *Downingia* (California Natural Diversity Data Base 2003).

d. Reasons for Decline and Threats to Survival

Most species addressed in this recovery plan are threatened by similar factors because they occupy the same vernal pool ecosystems. These general threats, faced by all the covered species, are discussed in greater detail in the Introduction section of this recovery plan. Additional, specific threats to *Navarretia leucocephala* ssp. *pauciflora* are described below.

Continuing specific threats involving potential loss or fragmentation of habitat include: (1) various disturbances of the volcanic ash soils, which accelerates erosion, at Manning Flat (Bittman 1989, A. Buckmann pers. comm. 2001); (2) off-road vehicle use continuing to degrade certain habitat (Bittman 1989, California Natural Diversity Data Base 2005); (3) erosion problems from attempts to drain habitat (California Natural Diversity Data Base 2005); (4) land-use conversions for residential development or agriculture threatening all but two occurrences (J. Diaz-Haworth pers. comm. 2001, B. Flynn pers. comm. 2001); (5) possible inappropriate grazing practices at certain sites; and (6) possible population reductions of important insect pollinators.

e. Conservation Efforts

Navarretia leucocephala ssp. *pauciflora* was federally-listed as an endangered species on June 18, 1997 (U.S. Fish and Wildlife Service 1997b). The California Fish and Game Commission had previously listed *N. leucocephala* ssp. *pauciflora* as threatened in 1990 (California Department of Fish and Game 1991). The California Native Plant Society included this plant in their first listing of rare plants (Powell 1974). Currently, *N. leucocephala* ssp. *pauciflora* is on the California Native Plant Society's List 1B and has the highest endangerment rating possible (California Native Plant Society 2001).

The Mead Ranch population of *Navarretia leucocephala* ssp. *pauciflora* in Napa County is protected from development by a conservation easement (California Natural Diversity Data Base 2003). A private citizen bought the Cobb-area vernal pool that supports *N. leucocephala* ssp. *pauciflora* and *Eryngium*

constancei specifically to protect these species from potential threats (J. Diaz-Haworth pers. comm. 2001, B. Flynn pers. comm. 2001). One of the sites near Loch Lomond is now protected by the California Department of Fish and Game as a Vernal Pool Ecological Reserve and is managed for the benefit of several rare plants (California Department of Fish and Game 1994, California Natural Diversity Data Base 2003). However, the *Navarretia* at that site is an intermediate form (A. Day *in litt.* 1997).

Surveys conducted by California Native Plant Society members and California Department of Fish and Game personnel in the 1990s led to the discovery of several new or historical populations. In 1988, the California Native Plant Society petitioned the California Fish and Game Commission to list *Navarretia leucocephala* ssp. *pauciflora* (Bittman 1989, California Department of Fish and Game 1990a).

7. NAVARRETIA LEUCOCEPHALA SSP. PLIEANTHA (MANY-FLOWERED NAVARRETIA)

a. Description and Taxonomy

Taxonomy.—Many-flowered navarretia is in the phlox family. The name first assigned to many-flowered navarretia was *Navarretia plieantha*. The type locality for the species is Boggs Lake, in Lake County (Mason 1946). Day (1993a) later reduced many-flowered navarretia to the rank of subspecies, under the name *Navarretia leucocephala* ssp. *plieantha*.

As explained in the species account for *Navarretia leucocephala* ssp. *pauciflora*, some populations of *Navarretia* consist of individuals intermediate in characteristics between two subspecies. According to Dr. Alva Day (*in litt.* 1997, pers. comm. 1997), these plants are not properly called hybrids nor “intercrosses,” as the final listing rule (U.S. Fish and Wildlife Service 1997b) described them. Dr. Day (*in litt.* 1997) has distinguished two types of intermediate specimens, which others have identified as *N. leucocephala* ssp. *plieantha*. One group is intermediate between *N. leucocephala* ssp. *pauciflora* and *N. leucocephala* ssp. *plieantha*, and the other is intermediate between *N. leucocephala* ssp. *plieantha* and *N. leucocephala* ssp. *bakeri* (Baker’s navarretia). For convenience, we refer to all of these as *N. leucocephala* ssp. *plieantha* throughout this plan, but the population at the type locality is referred to as “typical” *N. leucocephala* ssp. *plieantha*.

Description and Identification.—Characteristics common to all members of this genus were presented in the *Navarretia leucocephala* ssp. *pauciflora*

account. *Navarretia leucocephala* ssp. *plieantha* (**Figure II-10**) forms mats 5 to 20 centimeters (2.0 to 7.9 inches) across and 1 to 3 centimeters (0.4 to 1.2 inches) high. The stems have a peeling, white surface and are highly branched. Stem thickness is 0.8 to 1.4 millimeters (0.03 to 0.06 inch) and is more or less uniform throughout its length. The leaves are 3 to 4 centimeters (1.2 to 1.6 inches) long and are either entire or have a few thread-like lobes. Flower heads are 1.5 to 2 centimeters (0.6 to 0.8 inch) across and contain between 10 and 60 pale blue flowers. Each flower in the head is 5 to 6 millimeters (0.20 to 0.24 inch) long. The capsule and seeds are similar to those of *N. leucocephala* ssp. *pauciflora*; each fruit may contain as many as three seeds (Mason 1946, Day 1993b). The chromosome number is unknown.

Navarretia leucocephala ssp. *plieantha* has up to twice as many flowers per head as *N. leucocephala* ssp. *pauciflora*, and the former also has more highly branched outer bracts with needle-like tips on the lobes (A. Day *in litt.* 1993). Moreover, *N. leucocephala* ssp. *plieantha* does not have a thicker stem below ground level and its corolla is about the same length as its calyx. *Navarretia leucocephala* ssp. *bakeri* differs from *N. leucocephala* ssp. *plieantha* in that the former has an erect habit, stems up to 15 centimeters (5.9 inches) tall, and white corollas. Other vernal pool navarretias have corolla lobes with more veins, corolla tubes longer than the calyx, calyx lobes of unequal length, or different stamen attachment (Mason 1946, Crampton 1954, Munz and Keck 1968, Day 1993b). Identifying features of upland navarretias were described under *N. leucocephala* ssp. *pauciflora*.

b. Historical and Current Distribution

Historical Distribution.—The California Natural Diversity Data Base (2005) includes seven occurrences of *Navarretia leucocephala* ssp. *plieantha*, (California Natural Diversity Data Base 2005) (**Figure II-5**). The final rule for *N. leucocephala* ssp. *plieantha* (U.S. Fish and Wildlife Service 1997b) erroneously reported eight historical locations instead of the nine that were catalogued by the California Natural Diversity Data Base at that time. The historical occurrences are from Lake and Sonoma Counties.

Typical *Navarretia leucocephala* ssp. *plieantha* was known historically only from Boggs Lake (A. Day *in litt.* 1993, 1997). The other reported occurrences include six sites with plants that are intermediate between *N. leucocephala* ssp. *plieantha* and other subspecies, and two sites where Dr. Alva Day does not have access to specimens to confirm the identity of the plants (A. Day *in litt.* 1993, 1997). Three historical occurrences in Lake County (Loch Lomond, Mount Hannah Lodge, and

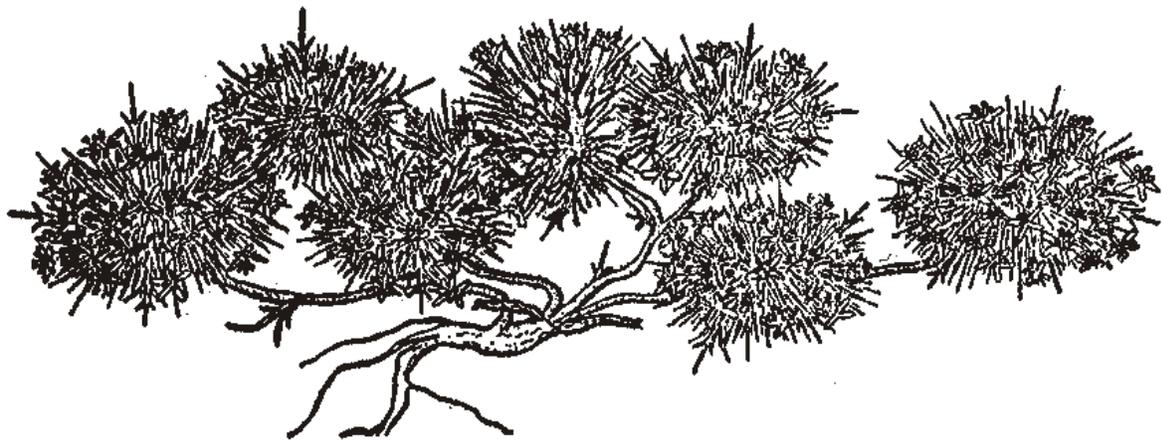


Figure II-10. Illustration of *Navarretia leucocephala* ssp. *pliantha* (many-flowered navarretia). Reprinted with permission from Abrams (1951), *Illustrated Flora of the Pacific States: Washington, Oregon, and California*, Vol. III. © Stanford University Press.

Siegler Springs Road) have plants intermediate between *N. leucocephala* ssp. *pauciflora* and *N. leucocephala* ssp. *plieantha*. At least three occurrences in the Santa Rosa area, in Sonoma County, consist of plants intermediate between *N. leucocephala* ssp. *plieantha* and *N. leucocephala* ssp. *bakeri* (A. Day *in litt.* 1993, 1997). Dr. Day has not seen specimens from Stienhart Lake in Lake County and thus cannot confirm that *N. leucocephala* ssp. *plieantha* occurs there (A. Day *in litt.* 1997).

Current Distribution.—Of the seven occurrences the California Natural Diversity Data Base (2005) has catalogued as *Navarretia leucocephala* ssp. *plieantha*, all are considered to be extant. Please refer to the Draft Santa Rosa Plains Recovery Plan (in development) for information regarding occurrences within the Santa Rosa vernal pool region identified by Keeler-Wolf *et al.* (1998).

The five occurrences reported as extant in the final rule (U.S. Fish and Wildlife Service 1997b) were Boggs Lake, Loch Lomond, Mount Hannah Lodge, Siegler Springs Road, and Stienhart Lake, which are in the Lake-Napa Vernal Pool Region (Keeler-Wolf *et al.* 1998). These occurrences are still believed to be extant, although only three populations have been revisited since 1989 (California Natural Diversity Data Base 2005). The typical population of *Navarretia leucocephala* ssp. *plieantha* at Boggs Lake has not declined (Baldwin and Baldwin 1991, California Natural Diversity Data Base 2005).

c. Life History and Habitat

Reproduction and Demography.—The basic life history of *Navarretia leucocephala* ssp. *plieantha* presumably is similar to that of *N. leucocephala* ssp. *pauciflora*, although neither has been studied intensively. Three different measures of abundance collected annually from 1987 through 1991 at Boggs Lake revealed that the *N. leucocephala* ssp. *plieantha* population in the lakebed had increased in abundance while that in the adjoining meadow had decreased. *Navarretia leucocephala* ssp. *plieantha* plants rarely had more than one flower head each during the monitoring period (Baldwin and Baldwin 1991). In certain years, competition from associated plants along the lake margin apparently caused the *N. leucocephala* ssp. *plieantha* plants to develop longer, less robust stems (Baldwin and Baldwin 1990).

Habitat and Community Associations.—Typical *Navarretia leucocephala* ssp. *plieantha* occurs only at Boggs Lake. The lake itself is classified as a Northern Volcanic Ashflow Vernal Pool (Sawyer and Keeler-Wolf 1995), which consists of a clay layer that is impervious to water and is buried under a layer of volcanic ash (California Department of Fish and Game 1987b). Mason

(1946:200) noted that he collected the type specimen “In peaty soil of lake margin surrounded by a black oak, madrone [*Arbutus menziesii*], Douglas fir, and yellow pine [*Pinus ponderosa*] forest.” More recent reports from Boggs Lake indicated that *N. leucocephala* ssp. *plieantha* also can grow in the center of the lake bed and in wet portions of the surrounding meadow (Baldwin and Baldwin 1989a, Baldwin and Baldwin 1991). The soil at Boggs Lake is in the Collayomi-Aiken-Whispering complex. Numerous plant species are associated with *N. leucocephala* ssp. *plieantha* at Boggs Lake, including *Eryngium aristulatum*, *Plagiobothrys stipitatus*, *Downingia* spp., and several other species of *Navarretia*. Rare plants that co-occur with typical *N. leucocephala* ssp. *plieantha* include *Orcuttia tenuis* and *Gratiola heterosepala* (Baldwin and Baldwin 1989a, California Natural Diversity Data Base 2003). The elevation of Boggs Lake is approximately 850 meters (2,800 feet) (California Natural Diversity Data Base 2005).

Elsewhere, *Navarretia leucocephala* ssp. *plieantha* occurs in vernal pools, vernal lakes, and swales (California Natural Diversity Data Base 2003). Occupied pools are classified as “Northern Vernal Pools” or Northern Volcanic Ashflow Vernal Pools (Sawyer and Keeler-Wolf 1995, California Natural Diversity Data Base 2003). *Pinus ponderosa* forest or mixed forests of *Quercus kelloggii*, *Pseudotsuga menziesii*, and *Pinus ponderosa* typically occur in the surrounding areas (California Department of Fish and Game 1987b, California Natural Diversity Data Base 2003).

Associates of *Navarretia leucocephala* ssp. *plieantha* throughout its range are similar to those at Boggs Lake (California Natural Diversity Data Base 2003). Other plants featured in this recovery plan that co-occur with *N. leucocephala* ssp. *plieantha* include *Eryngium constancei*, *Orcuttia tenuis*, *Gratiola heterosepala*, and *Legenere limosa*. In addition, the endangered plant *Lasthenia burkei* co-occurs with *N. leucocephala* ssp. *plieantha* in Sonoma County (California Natural Diversity Data Base 2005).

At three sites that support *Navarretia leucocephala* ssp. *plieantha*, the soils are mapped in the Collayomi-Aiken-Whispering complex, whereas the Stienhart Lake site has soils in the Konocti-Hambright complex. Soil types are not known for the other occurrences. At Loch Lomond, *N. leucocephala* ssp. *plieantha* is found in the deeper parts of the pool (California Department of Fish and Game 1994). Known sites range in elevation from 33 meters (110 feet) north of Santa Rosa to 853 meters (2,800 feet) at Loch Lomond (California Natural Diversity Data Base 2005).

d. Reasons for Decline and Threats to Survival

Most species addressed in this recovery plan are threatened by similar factors because they occupy the same vernal pool ecosystems. These general threats, faced by all the covered species, are discussed in greater detail in the Introduction section of this recovery plan. Additional, specific threats to *Navarretia leucocephala* ssp. *plieantha* are described below.

Unique to *Navarretia leucocephala* ssp. *plieantha* are three habitat impacts not generally reported as important factors in the declines of the other vernal pool species: rooting by feral pigs, horseback riding, and foot traffic related to human recreational activity. Hybridization has also been cited as a reason for the decline of *N. leucocephala* ssp. *plieantha* (Bittman 1989, California Department of Fish and Game 1990a), but the presence of intermediate forms is not evidence of any threat. The intermediates are not believed to be hybrids (A. Day *in litt.* 1997, pers. comm. 1997), and the fact that similar specimens were collected historically at all sites with intermediate plants indicates that the intergradation is not a recent phenomenon (A. Day *in litt.* 1993).

Other threats are also continuing. In particular, at Boggs Lake, competition from *Typha* spp. (cat-tail), *Centaurea solstitialis* (yellow star-thistle), and a native thistle (*Cirsium remotifolium*) threaten to crowd out *Navarretia leucocephala* ssp. *plieantha* (Baldwin and Baldwin 1991). Competition from nonnative plants such as *Taeniatherum caput-medusae* and *Centaurea solstitialis* threatens *N. leucocephala* ssp. *plieantha* at the site east of Mount Hannah Lodge. Random events pose a threat to two small populations, one east of Mount Hannah Lodge and another in Sonoma County, which number only a few hundred individuals in even the most favorable years (California Natural Diversity Data Base 2003). Please refer to the Draft Santa Rosa Plains Recovery Plan (in development) for information regarding threats facing *Navarretia leucocephala* ssp. *plieantha* in the Santa Rosa vernal pool region, as identified by Keeler-Wolf *et. al.* (1998).

e. Conservation Efforts

A final rule listing *Navarretia leucocephala* ssp. *plieantha* as an endangered species was published on June 18, 1997 (U.S. Fish and Wildlife Service 1997b). *Navarretia leucocephala* ssp. *plieantha* had previously been listed as endangered by the California Fish and Game Commission since 1979 (California Department of Fish and Game 1991). The California Native Plant Society has long recognized *N. leucocephala* ssp. *plieantha* as rare and endangered (Powell 1974); it is currently on List 1B and is ranked as “endangered in a portion of its range” (California Native Plant Society 2003).

Two localities for *Navarretia leucocephala* ssp. *plieantha* are protected as reserves. The Trust for Wildland Communities manages the Boggs Lake Preserve and the California Department of Fish and Game manages the Loch Lomond Vernal Pool Ecological Reserve. Management activities at the two reserves include annual monitoring, protective measures such as fencing, and removal of competitors, and interpretive displays (Baldwin and Baldwin 1991; California Department of Fish and Game 1991, 1994).

Additional past conservation efforts included a 1985 survey throughout the range of *Navarretia leucocephala* ssp. *plieantha* (California Department of Fish and Game 1987b) and a survey in the Santa Rosa area of Sonoma County in 1988 (Waaland and Vilms 1989). Please refer to the Draft Santa Rosa Plains Recovery Plan (in development) for specific information regarding *Navarretia leucocephala* ssp. *plieantha* conservation efforts.

8. *NEOSTAPFIA COLUSANA* (COLUSA GRASS)

a. Description and Taxonomy

Taxonomy.—Colusa grass is a member of the subfamily Chloridoideae in the grass family (Poaceae) and is in the Orcuttieae tribe, which also includes *Orcuttia* and *Tuctoria* (Reeder 1965, Keeley 1998). Davy (1898) first described Colusa grass, giving it the Latin name *Stapfia colusana*. He had collected the type specimen near the town of Princeton in Colusa County. Davy soon realized that the name *Stapfia* had already been assigned to a genus of green algae and therefore changed the scientific name of Colusa grass to *Neostapfia colusana* (Davy 1899). The name *Anthochloa colusana* was used for decades after Scribner (1899) published the combination in the mistaken belief that Colusa grass was closely related to a South American species of that genus. However, Hoover (1940) evaluated the many differences between *Anthochloa* and *Neostapfia* and concluded that the latter should be considered a distinct genus. Since that time, the accepted name for Colusa grass has been *Neostapfia colusana*. No other species of *Neostapfia* are known (Reeder 1982, Reeder 1993). *Neostapfia* is the most primitive member of the tribe (Keeley 1998).

Description and Identification.—All members of the Orcuttieae share several characteristics that differ from many other grasses. Most grasses have hollow stems, but the Orcuttieae have stems filled with pith. Another difference is that the Orcuttieae produce two or three different types of leaves during their life cycle, whereas most grasses have a single leaf type throughout their life span. The juvenile leaves of the Orcuttieae, which form underwater, are cylindrical and clustered into a basal rosette. After the pool dries, terrestrial leaves form in all